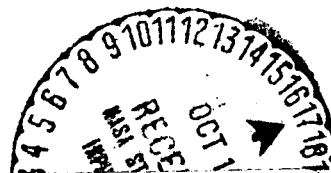


NEW METHOD FOR THE STUDY OF SOLID PARTICLES
IN THE STRATOSPHERE

by

R. Challande and B. David

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A NEW METHOD FOR THE STUDY OF SOLID PARTICLES IN THE STRATOSPHERE

by

Rene Challande and Benjamin David *

A new method by which microscopic and submicroscopic particles can be collected simultaneously in the same experiment is described. Use is made of the properties of an ionized electric field under the conditions imposed by rarefied air. The apparatus, based on this principle, performed according to the builders' designs during a balloon ascension to an altitude of about 15,000 meters on January 12, 1960.

The customary method of collecting dust at very high altitudes during sounding-balloon ascensions consists in collecting them on a filter paper. This method, which makes it possible to have an accurate idea of the overall radioactivity of the aerosol, gives no indication whatsoever of the size of the carriers. The following method overcomes this drawback.

The precipitator consists essentially of a tube with an axial ionizing wire. The charged particles are directed by the electric field towards the walls. The classic law, valid for particle sizes larger than 0.5μ , shows that the particles entrained by air flowing into the tube at a constant rate are deposited according to decreasing size [1]. We collected these particles on a transparent motion-picture film treated so as to remain conductive under low-pressure and low-temperature conditions.

* Report presented by Francis Perrin at the Meeting of February 8, 1960.

The submicroscopic particles are charged more slowly, and deposition takes place on the basis of increasing size [2]. This dust was collected on electron-microscope specimen holders evenly arranged in 0.3-cm cells on a generatrix of the tube. The dimensions of the tube were calculated so as to collect all of the dust introduced therein (length, 40 cm; diameter, 4 cm).

The ionizing field depends on the ionization current which is itself a function of pressure. The high voltage of the wire must be sufficient to produce this current, but it must be lower than the breakdown voltage. The high voltage is fixed (at 1,600 volts in the experiment). It is applied to the wire only in a zone lying between two specific elevations. A metal barometer, which actuates a contact by means of its pointer, controls the application of voltage to the wire.

The high voltage is supplied by a transistorized oscillator followed by a transformer; it is of the C.E.A., S.P.I type (manufactured by Mesco); its output is 200 μ A.

Proper operation of the apparatus as a whole was checked in a vacuum tank prior to sending it aloft.

The total weight of the apparatus is 4,770 g. It was sent aloft at Trappes (Seine et Oise) on January 12, 1960, and it was recovered 12 km Southwest of Gien (Loiret) after reaching a height of 15,914 meters.

Dust collection was carried out at altitudes ranging between 9,800 and 13,800 m, on a vertical line with respect to a region situated between 40 and 55 km Southeast of Trappes. The lower limit of the stratosphere in this region on that day was 9,400 meters.

Precipitation lasted 19 min. on ascension, and 9 min. on descent; the total volume of air thus filtered, at the rate of 64 l/min., was 1,792 liters.

The section studied contains amorphous dust, single crystals, and clusters of crystals less than one micron in size. The examination of the collection band of particles larger than 0.5μ showed that, on the average, there were 350 particles larger than 5μ per liter of air on that day.

This result approximates those obtained with the same apparatus in September 1959 at a height of 3,620 m, at ground level in the High Alps (Laboratoire de l'Aiguille du Midi; Aiguille du Midi Laboratory), where the concentration was 400 ± 50 particles larger than 5μ per liter of air (September 17: 466; September 18: 322; September 19: 345), and 206 particles $> 5 \mu/l$ were obtained by another method at the same site in the autumn of 1958.

The examination of the submicroscopic particles collected in the capsules at the time of the flight of January 12, 1960 is in progress.

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